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## **Abstract**

In a partnership with the Departments of Residence Life, Facilities, Psychology and the Institute of Environmental Sustainability, Loyola University Chicago installed water efficient fixtures on campus, engaged students to reduce their water use, and shared lessons learned with Illinois colleges and universities. From the residence hall water conservation retrofit, we learned that (1) it takes time and coordination to install retrofits; (2) retrofit installations are best done when students are not living in the residence hall; and (3) it is useful to engage with student teams and have them use the university as a learning laboratory. From the student behavior change campaign, we learned (1) to identify and promote behaviors that are do-able; (2) to create a memorable and well communicated poster, incorporate humor, campus celebrities, social norms, and images of vivid consumption to make messages memorable; and (3) that perceived behavior change does not necessarily translate to water conservation. From the lab retrofit campaign, we learned that (1) staff members and academic units are not incentivized to seek out and use water efficient fixtures; and (2) operational units such as facilities or budget departments are motivated to seek water savings.

## 1. Introduction

Located on the shore of Lake Michigan, Loyola University Chicago (hereafter, Loyola) is deeply committed to preserving the health and beauty of our region's rich water resource. A recent policy change by the City of Chicago removed the nonprofit exemption in paying for water, which affects Loyola. This, combined with an incremental increase in the price of water (Figure 1), has made the conservation of potable water an increased priority for the institution.

Upon investigation of past utility bills, we found that residence halls consumed the greatest amount of water (Figure 2). As such, we gathered interest from students on the topic of water reduction, and they were receptive to taking this inquiry on as a student classroom project. In 2014, we mentored a group of students to investigate which residence halls consumed the most water. The results of their audit are illustrated in Figure 3.

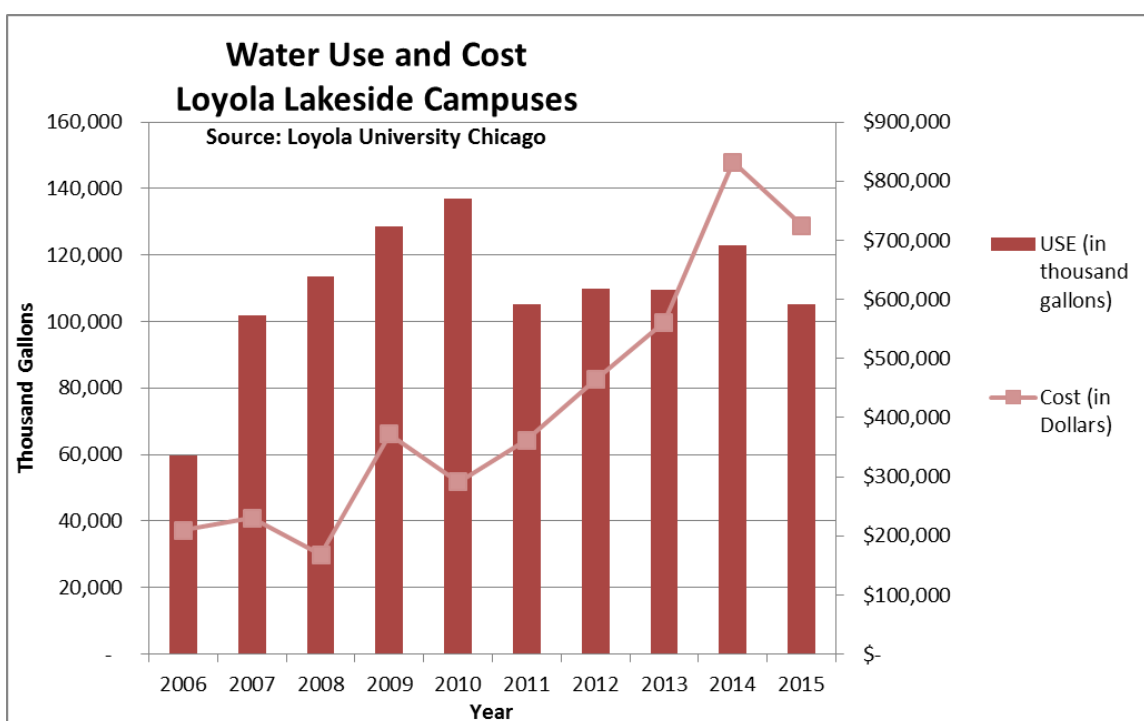


Figure 1: Water use and cost, Loyola Lakeside Campuses.

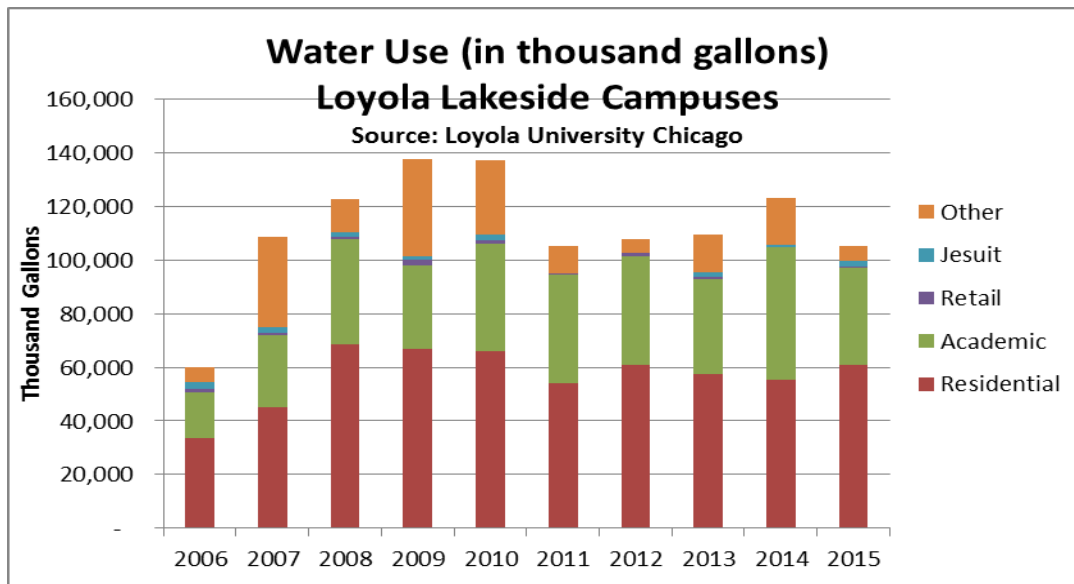


Figure 2: Water use (in thousand gallons), Loyola Lakeside Campuses.

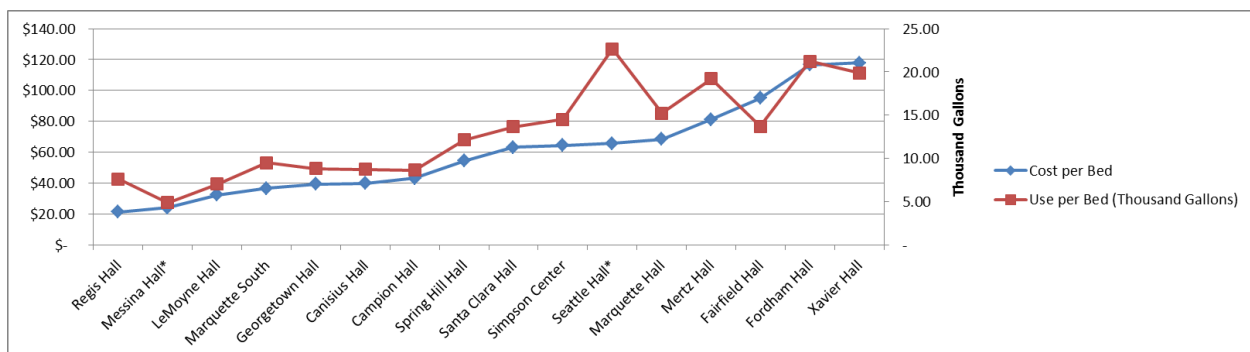


Figure 3: Water use and cost by residence hall.

The grant we received from the Illinois Sustainable Technology Center gave us the opportunity to take action on the insight that reducing water in residence halls would make the largest impact on Loyola's overall water use. Along the way, we were able to take on some other topics including an inter-disciplinary research initiative on identity-based behavior change with the Department of Psychology and the challenges of providing water conserving equipment to teaching laboratory settings.

## **2. Methods, Results, and Discussion**

### ***2.1. Residence Hall Retrofits***

#### **2.1.1 Lake Shore Campus**

Our method for the residence hall retrofits was to research, install, engage, learn, and share. We met with staff members from our facilities department and residence life team to get their input on which halls would be best to target and which halls were in need of retrofits. We also researched the latest in water efficient fixtures by reaching out to university contacts, industry groups, and water professionals. We learned that purchasing the most water efficient fixture in a residence hall is very specific to the region, pipes, and unique use of each building. These water experts advised us to test the fixtures first and then scale the installation if they perform well.

As a pilot effort, we planned to convert five tank toilets into dual flush toilets in select residence halls. We chose rooms that belonged to resident assistants (RAs) in order to receive honest and timely feedback on the fixture. While in the process of converting the toilets, we learned that the dual flush conversion kit we purchased did not fit American Standard toilets because the equipment was too large to fit into the tank. Fortunately, the kits did fit into Gerber toilets. Therefore, only three toilets in the Marquette resident hall were successfully retrofitted over fall break of 2014. Most students were pleased with the functionality of their new dual flush toilet, so we decided to proceed with expanding the retrofit into all eligible rooms in Fairfield and Marquette North residence halls.

To begin that process, our facilities department surveyed Fairfield and Marquette North to determine how many toilets were eligible for a dual flush conversion. They found that among the 75 toilets in Fairfield, only 11 were viable candidates for the retrofit. The remaining 64 toilets would need to be replaced altogether in order to be water efficient. This would require additional work beyond the scope of this grant, including floor and wall repairs and deferred maintenance to the plumbing equipment. In Marquette North, they found that among the 58 toilets in the building, 47 could be retrofitted into dual flush. Another constraint that limited the number of toilets that could be retrofitted was due to our experimental design which was planned and co-led by the Department of Psychology. As discussed later, halls in the behavior change only or control treatment group were not eligible for efficient fixtures during the 2015 spring semester.

While students were on winter break (December 2014), the Facilities team installed 58 dual flush conversions onto tank toilets – 11 in Fairfield and 47 in Marquette North. The complete list of retrofitted equipment is in the Appendix A. We partnered with Peoples Gas, and through their Commercial and Industrial Energy Jumpstart program, water inefficient showerheads and faucets were also replaced with low-flow showerheads and aerators at no cost. Peoples Gas changed out 133 showerheads (75 in Fairfield and 58 in Marquette North). They also installed 266 aerators (150 in Fairfield and 116 in Marquette North). In total, we installed 597 new pieces of equipment into residence halls.



Given this change in fixtures, we designed and placed educational stickers in key areas of students' bathrooms to encourage them to be more aware of their water use (Figures 4-7).

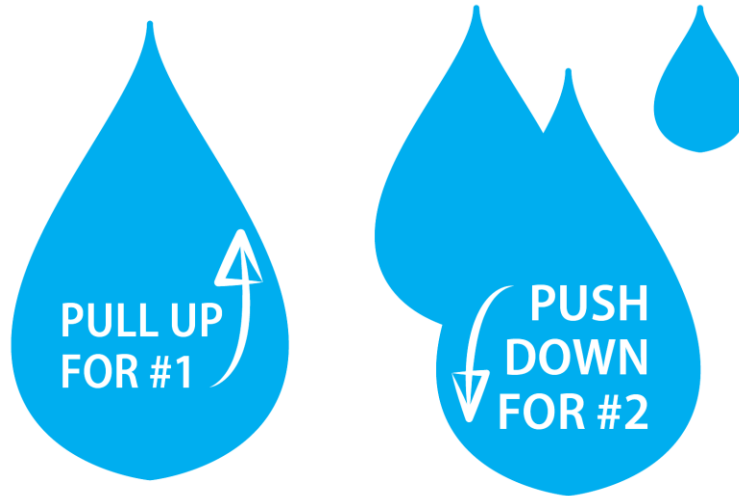


*Figure 4: Water saving shower sticker.*



*Figure 5: Water saving shower sticker in a shower.*

NOW THERE'S TWO WAYS TO FLUSH!



*Figure 6: Dual flush toilet sticker.*



*Figure 7: Dual flush toilet sticker on a toilet.*

In collaboration with the psychology department (see section 2.2 for more information), we surveyed a select group of students in November 2014 and in April 2015 (which was before and after the retrofits, respectively) and inquired how much they liked or didn't like their toilet, kitchen faucet, and bathroom faucet. The results of the before and after retrofit survey were fascinating. Below are highlights of what the survey data showed.

- There were no significant differences between how much the students liked their toilet or kitchen faucet between the first survey and the second survey (after the retrofits were installed).
- Students tended to like their showerhead more after the retrofit than before.
- Students liked their bathroom faucet more before the retrofit rather than after the retrofit.

The Statistical Package for the Social Sciences (SPSS) output is on pg. 7.

In summation, the students liked the showerhead, toilet, and kitchen faucet retrofits, but they did not care for the bathroom faucet, so future retrofits will need to take into consideration that students might appreciate a higher gallon per minute rate in their bathroom faucet.

With these retrofits installed, we project that 2,353,800 gallons of water will be saved annually.

During the process of retrofitting fixtures and surveying the residence halls, we learned that the majority of the residence halls had already been retrofitted with new fixtures. The buildings that are water inefficient are either in use all year long so we could not do work in those buildings without causing severe disruptions, or there would need to be a large capital investment in order for water-conserving fixtures to be installed. This posed a challenge for us in achieving the large number of retrofits that we were seeking. Therefore, we explored other areas on the Lake Shore and Water Tower campus to improve water efficiency. The facilities department surveyed two additional buildings – Arrupe House and Gonzaga Hall – and determined that 10 out of the 30 tank toilets could be retrofitted in Arrupe House and 12 out of the 30 tank toilets in Gonzaga Hall could be retrofitted to be dual flush. Over the summer of 2015, we converted these toilets to dual flush and also other tank toilets in additional locations across the Lake Shore campus. The following is our list of residence halls where we installed these fixtures.

- Seattle – 25 dual flush conversions
- Xavier – 27 dual flush conversions
- Georgetown – 50 single valves flush to double flush valves
- Marquette North – 10 toilet replacements

Fordham – 30 toilet replacements

**Paired Samples Statistics**

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	LikeShower Shower head	3.73	33	1.587	.276
	LikeShower.2	4.24	33	1.601	.279
	LikeShower.2.1: Shower head				
Pair 2	LikeToilet Toilet	3.82	33	1.424	.248
	LikeToilet.2 LikeToilet.2.1: Toilet	3.82	33	1.424	.248
Pair 3	LikeBFaucet Bathroom faucet	3.94	33	1.435	.250
	LikeBFaucet.2	3.00	33	1.521	.265
	LikeBFaucet.2.1: Bathroom faucet				
Pair 4	LikeKFaucet Kitchen faucet	3.79	33	1.576	.274
	LikeKFaucet.2	3.55	33	1.734	.302
	LikeKFaucet.2.1: Kitchen faucet				

**Paired Samples Correlations**

		N	Correlation	Sig.
Pair 1	LikeShower Shower head & LikeShower.2 LikeShower.2.1: Shower head	33	.322	.068
Pair 2	LikeToilet Toilet & LikeToilet.2 LikeToilet.2.1: Toilet	33	.261	.143
Pair 3	LikeBFaucet Bathroom faucet & LikeBFaucet.2 LikeBFaucet.2.1: Bathroom faucet	33	.272	.126
Pair 4	LikeKFaucet Kitchen faucet & LikeKFaucet.2 LikeKFaucet.2.1: Kitchen faucet	33	.638	.000

**Paired Samples Test**

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	LikeShower Shower head - LikeShower.2 LikeShower.2.1: Shower head	-.515	1.856	.323	-1.173	.143	-1.594	32	.121
Pair 2	LikeToilet Toilet - LikeToilet.2 LikeToilet.2.1: Toilet	.000	1.732	.302	-.614	.614	.000	32	1.000
Pair 3	LikeBFaucet Bathroom faucet - LikeBFaucet.2 LikeBFaucet.2.1: Bathroom faucet	.939	1.784	.311	.307	1.572	3.024	32	.005
Pair 4	LikeKFaucet Kitchen faucet - LikeKFaucet.2 LikeKFaucet.2.1: Kitchen faucet	.242	1.415	.246	-.259	.744	.984	32	.332

*Figure 8: SPSS Data from Water Survey.*

### 2.1.2. Water Tower Campus

Similar to the Lake Shore Campus, we worked with a team of students to conduct an audit of the Water Tower Campus, which includes a residential building and an academic building. As a result of the audit, the facilities department installed the following:

- Aerators in Corboy, Lewis Towers, and Maguire Hall (0.5 gpm)
- New faucets in Corboy (1.5 gpm)
- Autoflush urinals (from 1.5 to 1 gpf) and toilets (from 3.5 gpf to 1.6 gpf) in Lewis Towers

In total, the retrofits listed in this section (Lake Shore Campus residence halls and Water Tower Campus) are estimated to lead to a water savings of 4,009,800 gallons annually.

### **2.2. Behavior Change Campaign**

We worked closely with the psychology department to conduct a robust behavior change campaign. Initially, we planned to get guidance from the department on the messaging of the surveys to students, but when the psychology department learned more about this grant, they decided to be co-collaborators with us for this portion of the grant. Our methodology was to conduct a survey to ascertain a baseline for water use behaviors and attitudes, implement the campaign, conduct a follow up survey, and analyze the results using statistical tests, including .

With the help of residence life and the facilities departments, we targeted apartment-style residence halls that did not have water efficient fixtures. We divided the halls into four somewhat equal groups and assigned different treatments to them. Below is a breakdown of the groups.

Group 1 – Fairfield Hall (143 students) received retrofits and the behavior change campaign.

Group 2 – Marquette Hall (111 students) received only the water retrofits.

Group 3 – Georgetown and Spring Hill (171 students) received only the behavior change campaign.

Group 4 – Canisius, Seattle, and Xavier (153 students) did not receive any retrofits or behavior change campaign, and served as the control.

In the fall 2014 semester, we conducted a survey of all 578 students to establish their behaviors, attitudes, and knowledge about water use and environmental practices and habits in general. We partnered with residence life staff and worked with the resident assistants (RAs) of select residence halls to do outreach and encourage their residents to complete the survey. We provided the following incentives: if their group got a 50% or higher survey response rate, RAs received a t-shirt; and when a student completed the survey, the student received a \$3 gift card for a free coffee or tea at a nearby coffee shop. Six out of the 13 RAs achieved a 50% or higher response rate and received a t-shirt from Charity:Water. In total, 278 students responded (48% response rate), and all were given the gift card reward.

In the spring 2015 semester, we launched the behavior change campaign in Fairfield, Georgetown, and Spring Hill. The campaign consisted of the following components: “Welcome Back” goody bag, pledge, posters, and an interactive educational presentation. Inside the

“Welcome Back” goody bag was a dish soap, toothpaste, and a letter explaining the importance of conserving water, and it was placed right outside of each room as a gift to students upon their arrival back from winter break. What made this “Welcome Back” goody unique was the use of a campus celebrity – Sister Jean, a 95-year-old nun, who everyone on campus knows and admires. The dish soap and toothpaste packages pictured Sister Jean modeling the ideal water-conserving practice – turning off the water while doing the dishes and while brushing one’s teeth. The “Welcome Back” goody bag and stickers of Sister Jean are shown in Figures 8-10.



Figure 9: “Welcome Back” goody bag.



Figure 10: Sister Jean brushing her teeth without the water on and decal.



Figure 11: Sister Jean doing the dishes without the water on and decal.

During the first two weeks of class, student interns were stationed at the entry ways of Fairfield, Marquette, and Spring Hill to encourage students to sign a pledge to shorten their shower by two minutes for the next seven days. Students who signed the pledge received a button and tips on how to shorten shower times. We displayed the signed pledges in the entry way as well as on the students' apartment room doors as a daily reminder of their promise. Figures 11-14 show images of the pledge materials.



*Figure 12: Water pledge.*



*Figure 13: Button students received after they signed the pledge.*





*Figure 14: Water saving tips for students who signed the pledge.*



*Figure 15: Images of entryway with signed pledges.*

We designed water conservation posters using knowledge from social science on what makes an effective message (Allcott and Mullainathan, 2010; Bamberg and Moser, 2007; Bloodhart et. al., 2013, Campbell-Arvai et. al., 2012, Chaplin and Wyton, 2014, Cialdini et. al., 1990, Erickson and Skoglund, 2008, Feguson et. al., 2011, Gaspar, 2013, Gilbert et. al., 1990, Horhata et. al., 2014, Karp, 1996, Kollmuss and Agyeman, 2002, Parce et. al, 2013, Rokeach, 1971, Savageau, 2013, Chribert, 2010, Steg and Vlek, 2008, Thaler and Sunstein, 2008, Yates and Aronson, 1983). We worked with student interns to ensure the posters incorporated humor, social norms, and vivid consumption. Humor helps make a message memorable. Social norms encourage students to rethink their actions if most of their peers are taking a particular action; they typically do not want to be seen as a minority. Vivid consumption entails connecting the image of water saved (or any environmental impact) to something that students can relate to such as water filling up floors of a library. In addition to incorporating a campus celebrity in the “Goody Bag” materials, Sister Jean was also featured on these water-conserving posters. She is pictured brushing the teeth of the wolf in our “Wolf and Kettle” statue on campus. Tivo, a popular dog from the Wellness Center, is also a campus celebrity, and he was highlighted in these posters as well. We conducted two focus groups with psychology and environmental science majors to gather input on the poster designs. Because a message’s impacts erode with time, we designed three distinct batches of posters that were placed in key areas for short periods of time in order to ensure that the water conservation message was new and fresh. Immediately after the winter semester began, we posted the water conservation posters in the entrance, stairs, elevator, laundry room, and high-traffic hallways (Figure 15). Three weeks later, in mid-February, the first batch of posters was removed, and the second batch was posted (Figure 16). Three weeks later, in early March, we removed the second batch of posters and posted the third and final batch (Figure 17).

The final component of the behavior change campaign was a presentation given to students. Students from Fairfield, Georgetown, and Spring Hill were invited to attend an interactive presentation created and delivered by one of our passionate water interns. We discussed what water means to us, heard two moving stories about how water affects two African women, learned eye-opening facts on water, and participated in a water activity. Knowing that the average distance African women walk to collect water is 3.7 miles (UN Water), we had students walk for a quarter of a mile carrying a five gallon bucket of water. This distance is only a fraction of the distance that African women carry on a daily basis, and it is only a small fraction of the amount of water used by the average American. According to the United States Geological Survey (accessed 8 August 2014), the average American uses 80-90 gallons of water a day. We hope this experience helped students put into context how precious water is for people around the world and that it is a resource for us to conserve and protect. Figure 18 shows images of the water poster and the first slide of the water presentation.

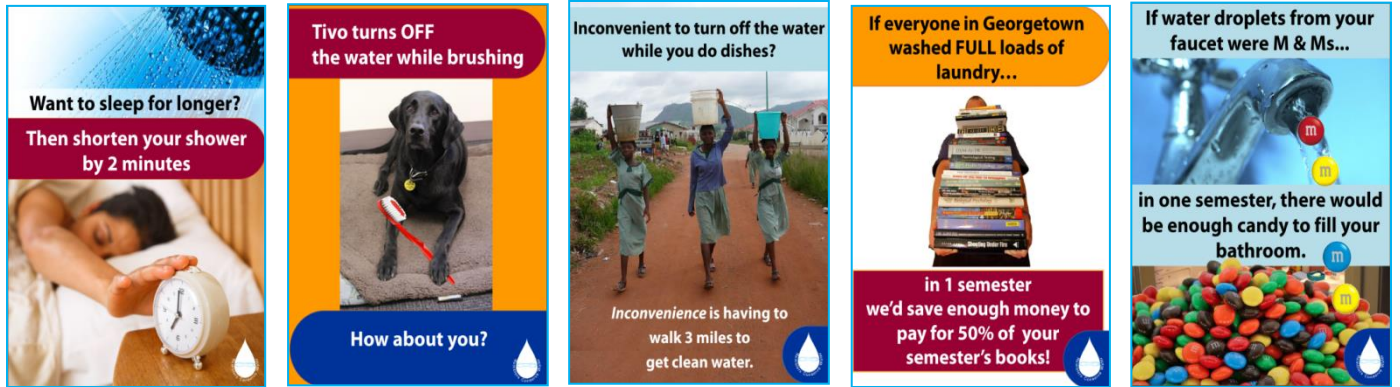


Figure 16: First round of water-conserving posters.



Figure 17: Second round of water-conserving posters.

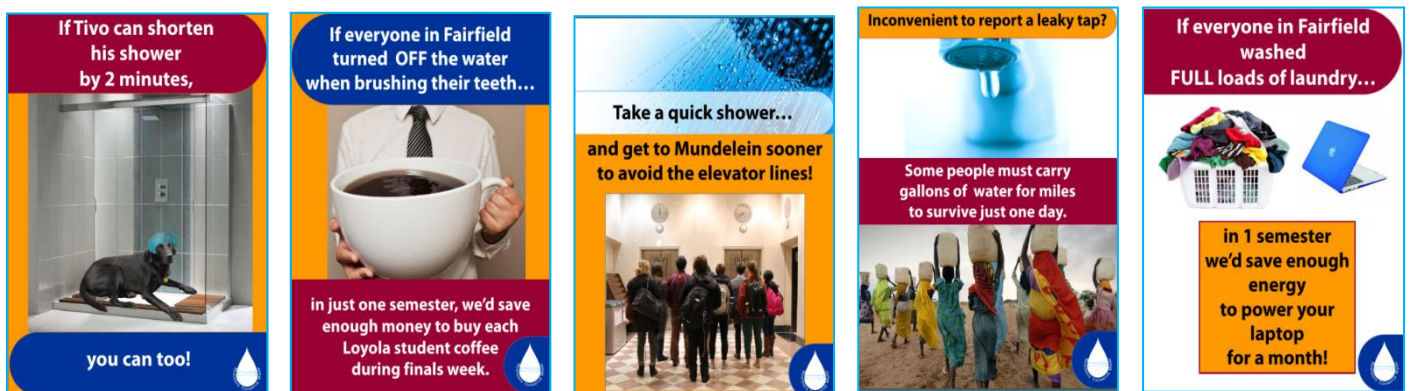


Figure 18: Third and final round of water-conserving posters.



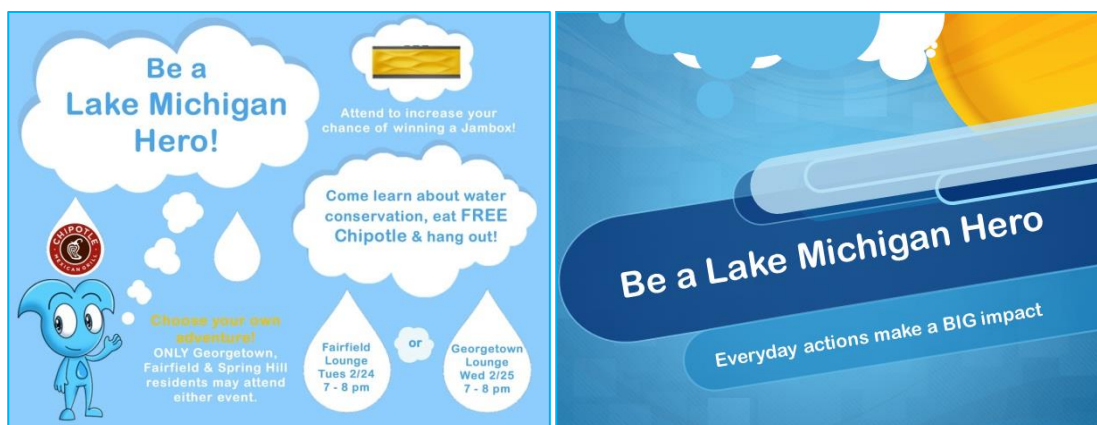


Figure 19: Outreach poster and water presentation slide.

In order to measure the effectiveness of the behavior change campaign, we conducted a follow up electronic survey in April 2015 of the 578 students originally surveyed in fall 2014. Again, we teamed up the resident assistants to increase the likelihood that students would respond. This time, RAs whose groups achieved a 50% or higher response rate were given a Charity:Water hoodie, and students who completed the survey were given a \$5 gift certificate to Amazon or Target and were entered into a raffle to win a Jambox bluetooth stereo. We had 303 student responses, which is a response rate of over 50%.

We used identity building techniques to persuade students to conserve water. We used phrases such as “Ramblers conserve” and “Be a Lake Michigan hero” to relate saving water to the students’ everyday life. Half of our participants received these identity-building messages along with information on ways to conserve water. The remaining participants received no information. These messages worked to reduce water use; students who received the campaign containing identity messages reported a stronger goal to conserve ( $t_{(269)} = -2.78, p = .006$ ) and used less water ( $t_{(269)} = 3.18, p = .002$ ) than students who did not receive these messages.

To conclude the project, we organized a “Water Conservation Carnival” in the Damen Student Center and educated over 200 students about water and water conservation. We had a water trivia game called “Wheel of Water,” in which students were quizzed on their water knowledge and received a water bottle, button, or \$3 coffee gift card if they got the trivia question correct. We also had a voting area where students voted on their favorite water poster and received a \$3 coffee gift card as a token of thanks for participating. Each student who engaged with us was given a complimentary cinnamon roll and tips on how to be a Water Champion. Below are images of the “Water Conservation Carnival.” In the Appendix B, you’ll find the complete list of questions from the “Wheel of Water.”



*Figure 20: Water conservation carnival setup.*



*Figure 21: Water wheel of trivia.*



*Figure 22: Water poster voting.*

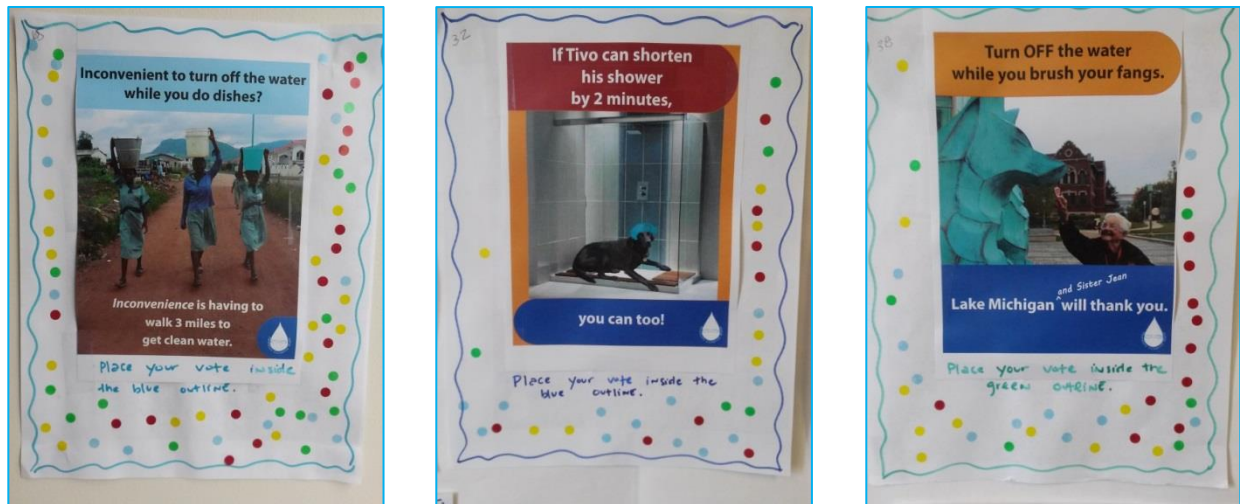


Figure 23: Top three water posters.

## Ways to Be a Water Champion...

- ◆ **Skip the bath and take a shower!** Taking a bath uses up to 70 gallons of water.
- ◆ **Shop consciously next time you need new jeans!** Your blue jeans may have taken 3,000 gallons of water to make.
- ◆ **Conserve water** so that the Great Lakes, which are a precious fresh water resource, will be around to enjoy for generations to come.
- ◆ **Cut back on red meat to reduce your impact!** A 1/3 pound hamburger takes 660 gallons of water to produce.

 **Remember:** Without water, life can't exist!  
Do your part and save water. 😊 

 Please recycle when you're done with me.

Figure 24: Tips to be a water champion.

This campaign taught us that the most effective outreach tools were posters and the “Welcome Back” goody bag. They reached the most number of students, and the “Welcome Back” goody bag was the most memorable, given the use of a campus celebrity. If time and resources allow for a pledge and educational presentation, we recommend that these elements be included in a behavior change campaign, as well.

Our results from the behavior change effort were primarily focused on the survey responses. These included reaction to retrofits, as well as student self-identification with the goal of water conservation. Most respondents had a positive reaction to the retrofitted equipment. Most students exposed to the water conservation campaign had a stronger goal to conserve. The relationship between students’ goals to conserve and their actual water use was mixed. We looked at water usage reported on water utility bills during the two-month behavior change intervention, and compared it to the average of the same period over the previous four years. The comparison showed residence hall(s) with

- \* Retrofits-only saw 38.8% water use reduction;
- \* Behavior change-only saw 18.5% water use *increase*;
- \* Retrofits and Behavior change saw 4.4% water use *increase*; and
- \* Control saw 13% water use *increase*.

While we are still conducting the statistical analysis on these results and attempting to understand the confounding variables, we think that perhaps self-reported water-conservation identity does not correspond to actual water use reduction. We anticipate understanding if these findings are statistically significant.

While it is best to combine a behavior change campaign in conjunction with retrofit installations, we are not certain if a behavior change campaign is necessary every year to maintain the water reduction of the first year. Further investigation would need to be done in order to determine the best way to sustain the lower use of water.

### **2.3. Lab Retrofits**

Our method was to do outreach, research, install, and measure water use. As a part of the annual lab safety seminar for all biology, chemistry, and environmental science lab researchers, we presented an opportunity to work on this grant-funded water efficiency project. We contacted professors and staff members in the chemistry department and the Institute of Environmental Sustainability to gauge their interest in retrofitting their labs. We received interest from two locations: the biodiesel lab and a chemistry teaching lab.

The proposed retrofit for the biodiesel lab was straightforward. Two faucets were using three gallons per minute, and they did not need this amount of water pressure. They chose a WaterSense faucet at 1.5 gpm, and our facilities department installed the faucet for them. The estimated water savings is 3,750 gallons per year.

The retrofit for the chemistry lab was more involved. There were 24 hoods in this particular chemistry lab. The lab instructor’s idea was to use a recirculating pump instead of using fresh

water during an experiment. Water flows through glass condensers, which is attached to a larger glassware setup containing hot vapors. The hot vapors that come in contact with the cooled glass walls from the running water are returned to the liquid state. During experiments, the pump would be taken out and attached to glass condensers. We reached out to various chemistry supply vendors and found a reasonably priced recirculating pump. The pumps were \$70 each, and collectively all 24 pumps will save the lab 50,000 gallons of water annually (Figures 24 and 25).



*Figure 25: Fume hoods in chemistry lab and condenser set up.*



*Figure 26: Recirculating pump by VWR.*



Given the limited interest in this project by Loyola faculty and academic units, we concluded that there is little to no incentive to reduce water in labs. The water savings do not get transferred to cost savings to the department itself but is realized as a whole in Loyola's overall water consumption. Two strategies could be considered to address this issue. Submetering could allow water budgeting at the academic unit level, providing financial incentives to departments that are able to conserve water. Although installing submeters is expensive, it would allow for a more accurate view of water use and consequently could provide more incentive for individual departments to save water. Another strategy would be to empower facilities or budget departments to have more authority in academic spaces such as labs.

For a summary of water efficiency retrofits supported in part or completely by this grant, see Appendix A. In total, the amount of water saved annually by these retrofits is 4,063,550 gallons and over the life of the fixtures, the water savings is projected to be 31,949,750 gallons. At 2015 water and sewer rates, this will save \$30,964 annually and \$243,964 over the life of the fixtures. At \$29,673 for materials cost only (not installation), this is under a one-year return on investment.

### **3. Conclusions and Recommendations**

#### **3.1. Residence Hall Retrofits**

The following are lessons learned and recommendations from the residence hall retrofits study.

- 1) Coordinating with multiple departments and service providers can be one of the most challenging aspects of installing water efficient fixtures at a university.
- 2) The best way to install retrofits is to test first and expand after getting input from users.
- 3) Reach out to the utilities to see if there are ways to partner on the retrofits. Peoples Gas was a great resource for us to ensure that all faucets had aerators and showerheads were low-flow.
- 4) Students do not have high expectations for water fixtures. If the fixtures are changed out in the middle of the semester, they do not mind.
- 5) It is easier to install retrofits during the summer so that there is less wait time and coordination with the retrofit schedule.
- 6) Using water data from Water Management has limitations related to the amount of time between when water is metered and when the bills are shared with us. If we had sub metering for water, it would have made the water consumption measurement more accurate and more easily accessible.

#### **3.2. Behavior Change**

The following are lessons learned and recommendations from the behavior change study.

- 1) Social norms, humor, and vivid consumption are key elements to incorporate into behavior change campaigns.
- 2) Linking students' identities to the campaign increases its effectiveness. We did this by using a campus celebrity, placing "Ramblers Conserve Water" on the water pledge button, and urging students to "Be a Lake Michigan Hero."
- 3) Students are not highly motivated to pick up their \$3 gift card if they have to go out of their way on campus to sign paperwork and pick it up. It was far more effective to have the incentive sent electronically to the student. It was also effective to go door-to-door between 3 – 6 PM to ask students if they had completed the survey.

#### **3.3. Lab Retrofits**

The following are lessons learned and recommendations from the lab retrofits study.

- 1) Water reduction is not incentivized within departments at Loyola. Therefore, it is difficult for lab instructors to seek out and use water efficient lab fixtures. In order for this to change, water needs to be linked to the operational cost of a department, so if the department reduced water, they would directly experience the savings.
- 2) As the primary beneficiaries of these interventions, facilities and budget departments may need to mandate this activity to see large-scale implementation.

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## **Appendix A: List of Retrofit Equipment by Location**

Table A1: List of Retrofit Equipment by Location. List includes anticipated water and cost savings as well as materials costs.

Retrofit Installed	Quantity	Location	Annual Water reduction (gallons)	Cost (material only)	Est. lifespan	Est. cost (materials only)	Est. Water Savings (Lifespan of fixture)	Est. Cost Savings Annual(\$7.62 per thousand gallons)	Est. Cost Savings (\$7.62 per thousand gallons for life of fixture)
Aerator	150	Fairfield	573,750	\$ 2.55	5	\$ 382.50	2,868,750	\$ 4,371.98	\$ 21,859.88
Aerator	116	Marquette	443,700	\$ 2.55	5	\$ 295.80	2,218,500	\$ 3,380.99	\$ 16,904.97
Aerator	90	Water Tower	1,147,500	\$ 2.55	5	\$ 229.50	5,737,500	\$ 8,743.95	\$ 43,719.75
Dualflush Valve	11	Fairfield	23,100	\$ 30.00	5	\$ 330.00	115,500	\$ 176.02	\$ 880.11
Dualflush Valve	47	Marquette	98,700	\$ 30.00	5	\$ 1,410.00	493,500	\$ 752.09	\$ 3,760.47
Dualflush Valve	50	Georgetown	105,000	\$ 30.00	5	\$ 1,500.00	525,000	\$ 800.10	\$ 4,000.50
Dualflush Valve	27	Xavier	56,700	\$ 30.00	5	\$ 810.00	283,500	\$ 432.05	\$ 2,160.27
Dualflush Valve	23	Seattle	48,300	\$ 30.00	5	\$ 690.00	241,500	\$ 368.05	\$ 1,840.23
Dualflush Valve	30	Arrupe	126,000	\$ 30.00	5	\$ 900.00	630,000	\$ 960.12	\$ 4,800.60
Dualflush Valve	30	Gonzaga	126,000	\$ 30.00	5	\$ 900.00	630,000	\$ 960.12	\$ 4,800.60
Showerhead	75	Fairfield	506,250	\$ 15.00	15	\$ 1,125.00	7,593,750	\$ 3,857.63	\$ 57,864.38
Showerhead	58	Marquette	391,500	\$ 15.00	15	\$ 870.00	5,872,500	\$ 2,983.23	\$ 44,748.45
Toilet	10	Marquette	26,700	\$ 125.00	20	\$ 1,250.00	534,000	\$ 203.45	\$ 4,069.08
Toilet	30	Fordham	80,100	\$ 125.00	20	\$ 3,750.00	1,602,000	\$ 610.36	\$ 12,207.24
Faucet	6	Water Tower	76,500	\$ 220.00	15	\$ 1,320.00	1,147,500	\$ 582.93	\$ 8,743.95
Faucet	2	Biodiesel Lab	3,750	\$ 220.00	15	\$ 440.00	56,250	\$ 28.58	\$ 428.63
Lab Reservoir	24	Quinlan Life Scie	50,000	\$ 70.00	10	\$ 1,680.00	500,000	\$ 381.00	\$ 3,810.00
Urinal valve	12	Water Tower	180,000	\$ 170.00	5	\$ 2,040.00	900,000	\$ 1,371.60	\$ 6,858.00
SubTotals									
	597	Residence Halls	2,353,800			\$ 12,413.30	22,348,500	\$ 17,935.96	\$ 170,295.57
	26	Labs	53,750			\$ 2,120.00	556,250	\$ 409.58	\$ 4,238.63
	168	Other	1,656,000			\$ 5,389.50	9,045,000	\$ 12,618.72	\$ 68,922.90
TOTAL	791		4,063,550			\$ 19,922.80	31,949,750	\$ 30,964.25	\$ 243,457.10

## **Appendix B: “Wheel of Water” Trivia Questions**



### **“Wheel of Water” Trivia Questions**

1. How many CTA train cars (filled with water) does it take to dye a pair of jeans?

2 CTA train cars

1/4 of a CTA train car

1/2 a CTA train car (3,000 gallons of water)

Source: Huffington Post -- [http://www.huffingtonpost.com/adam-j-rose/how-to-take-long-showers\\_b\\_6875644.html](http://www.huffingtonpost.com/adam-j-rose/how-to-take-long-showers_b_6875644.html)

2. True or False: Americans use the most water by flushing the toilet than any other indoor, water-using activity.

TRUE - If it's yellow, let it mellow.

26% of water used in an American household is from the toilet.

16% is from showers.

15% is from faucets.

13% is from leaks. Source: EPA -- <http://www.epa.gov/WaterSense/pubs/indoor.html>

3. How many gallons of water does the average American resident use per day?

130 gallons

100 gallons

70 gallons

Source: EPA -- [http://water.epa.gov/learn/kids/drinkingwater/water\\_trivia\\_facts.cfm](http://water.epa.gov/learn/kids/drinkingwater/water_trivia_facts.cfm)

4. What are the five Great Lakes?

Lake Superior, Lake Michigan, Lake Huron, Lake Erie, Lake Ontario

Clue: HOMES

5. What year did Loyola ban the sale of bottled water on campus?

2015

2004

2012

Students groups, Student Environmental Alliance (SEA) in partnership with Loyola's Unified Student Government Association (USGA), launched the UnCap LUC campaign in 2010 to educate the Loyola community on the issues associated with corporate ownership of water. In March 2012, Loyola students voted to end the sale of bottled water on campus.

6. Which is more?

The amount of water the US uses in a week.

OR

The amount of oil the world uses in a year.

Actually, the am't of water the US uses in 3 days is MORE the world uses oil in 1 yr.

According to the EPA, approximately 400 billion gallons of water are used in the United States per day.

7. Approximately how long can a person live without water?

One day

One week

One month

The average is 3 – 5 days and up to one week depending upon conditions. A person can live for one month without food.

Source: Eco Tech Water -- <http://www.ecotechwater.com/Company/watertrivia.html>

8. How many standard bathtubs full of water does it take to make a 1/3 pound of hamburger?

8 bathtubs (660 gallons of water)

2 bathtubs

15 bathtubs

Source: National Geographic -- <http://www.latimes.com/food/dailydish/la-dd-gallons-of-water-to-make-a-burger-20140124-story.html>

9. What is the largest readily available fresh water source on earth?

A) The Great Lakes

B) Glaciers

C) The Pacific Ocean

D) Polar ice caps

The Great Lakes are the largest surface freshwater system on Earth. Only the polar ice caps contain more fresh water (but they are not readily accessible). Source:

<http://www.epa.gov/glnpo/basicinfo.html>

Only 2.5% of all Earth's water is freshwater, which is what life needs to survive.

Of that 2.5% which is freshwater, almost all of it is locked up in ice and in the ground. Only 1.2% of all freshwater (which was only 2.5% of all water) is surface water. Src:

[water.usgs.gov/edu/earthwherewater.html](http://water.usgs.gov/edu/earthwherewater.html)

10. How can you save water while brushing your teeth?

Use more toothpaste

Turn the water off while brushing your teeth

Change your toothbrush

Turning off the water while you brush your teeth can save up to 4 gallons a minute. That's up to 200 gallons a week for a family of 4.

Src: Water Use ItWisely-- [wateruseitwisely.com/tips/category/indoor-tips/page/4/](http://wateruseitwisely.com/tips/category/indoor-tips/page/4/)

11. How can you save water while doing laundry?

Wash full loads

Combine loads with a friend

Handwash clothes

Both A & B

12) True or False: Taking a bath saves more water than taking a shower.

False. It usually takes ~70 gallons to fill a bathtub while a 5 min shower takes 10 – 25 gallons of water.

Src: National Geographic - <http://environment.nationalgeographic.com/environment/green-guide/quizzes/water-conservation/>